Eigenstructure of an Arrowhead Matrix Pencil

Piers W. Lawrence, Robert M. Corless

Abstract

The companion matrix pencil for polynomials expressed in the Lagrange basis or a Hermite interpolation basis, as used in several recent works as a convenient method for finding roots of such polynomials, has a spurious double root at infinity. This has been claimed to be harmless, but no detailed investigation has been published. This paper presents a perturbation analysis of the roots at infinity and, in the nondegenerate degree case, two deflations are given which exhibit the roots of the polynomial as a generalized and a standard eigenvalue problem. The numerical effects of such deflations are explored both theoretically and by computational examples.